

# An Environmental Friendly Leisure Boat

Mohd. Afifi Abd. Mukti, Kamarul Baharin Tawi, Omar Yaakob, Ahmad Nasirudin,

Mohd. Pauzi Abd. Ghani, Tholudin Mat Lazim

Faculty of Mechanical Engineering

Universiti Teknologi Malaysia, 81310 UTM Skudai

[afifi@fkm.utm.my](mailto:afifi@fkm.utm.my), [kamarul@fkm.utm.my](mailto:kamarul@fkm.utm.my), [omar@fkm.utm.my](mailto:omar@fkm.utm.my), [anasirudin@yahoo.com](mailto:anasirudin@yahoo.com),

[pauzi@fkm.utm.my](mailto:pauzi@fkm.utm.my), [tholudin@fkm.utm.my](mailto:tholudin@fkm.utm.my)

**Abstract:** This paper presents a development of an environmental friendly leisure boat. The study seeks to choose appropriate hull form configuration to minimize bank erosion, propulsion system and material to prevent air and water pollution. An asymmetric catamaran hull form configuration was selected and an electric motor with solar cell system was chosen as propulsion systems. GRP material was chosen to get easy maintain and corrosive resistant.

**Keywords:** environmental friendly leisure boat, asymmetric catamaran, electric motor, solar cell, GRP.

## 1. Introduction

Inland-waterways has been developed in Malaysia for leisure and transport of goods. Leisure crafts are widely used in lakes, dams and man made waterways such as the one in Putrajaya. In some states such as Sarawak there already exists relatively good network of river transportation while, in the Peninsular Malaysia, the government has identified Kedah River and Muar River sites for inland-waterways development. Currently, most of the inland-waterway vessels are not environmental friendly. Studies have shown these that vessels cause pollution on the environment [1], [2]. These vessels polluted the three (3) component of the environment that is water, land and air.

### 1) Water

The vessels generate wake that causes wash which erodes banks of rivers and lakes. This wake also rocks neighbouring crafts and causes unpleasant effects to anchored vessels and swimmers. Current coating used to prevent hull corrosion and for aesthetic also pollute the water. These coatings gradually dissolve and contaminate the water hence, endanger marine lives and also increases unnecessary cost to water authorities that has to filter these water for human consumptions. Similarly, the current standard internal combustion engine oil and lubricant leak and contaminate the water which also endanger marine and human lives. This polluted water discourages locals and tourist from engaging in water borne recreational industry.

### 2) Land

The wash generated by high wake from conventional hull form damages and causes land slides and endanger human's lives – buildings near by could collapse leading to lost of properties and lives. The debris due to these phenomena shallow and obstruct waterways leading to flash floods. On land engine maintenance could stained the sites as is usually observed in typical automotive workshops.

### 3) Air

As usual, standard internal combustion engine are noisy. This noise courses discomfort to crews, passengers, other users and fauna. Beside noise, engine emission also contributes to air pollution. For example, for small size boat with tail wind, the exhaust will be blown into the passenger cabin. This toxic gas is inconvenience and could causes health problems. To those who are sensitive to this exhaust fume, it could lead to respiratory effect and worst still can cause vomiting. The exhaust gas stench and stained clothing and the boat. In addition, secondary effects from the engine in terms of heat and fumes could trigger a fire.

With these environmental problems in mind, this project provides a practical solution.

## 2. Design and Development of a Prototype Environmental Friendly Boat

As fund for this project is quite limited, the group narrow down this prototype to be applicable for inland waterways such as Putrajaya lake. Through some simple survey and discussions carried by the group, the followings were found to be the desired attributes for an environmental friendly boat if it is to used in lake such as in Putrajaya:-

- Low noise.

- ii. Low wake
- iii. Low maintenance.
- iv. Low water and air pollution or if possible none at all.
- v. Relatively easy to handle.

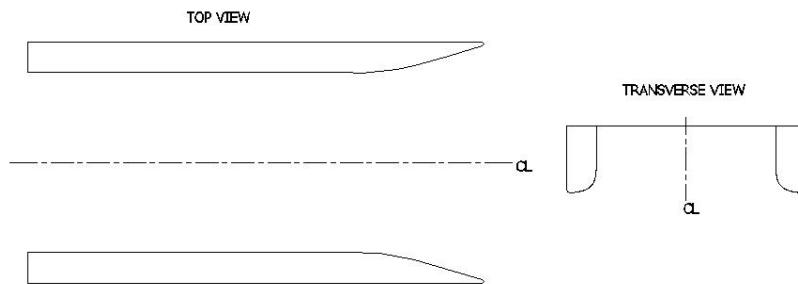
With these attributes the team came with the following specification for the prototype as shown in Table 1.

**Table 1. Main Particulars of prototype**

Hull Type	Asymmetric catamaran
Length Overall (LOA)	5.10 m.
Length Waterline (LWL)	5.02 m.
Breadth moulded of demihull	0.33 m.
Beam Overall	2.65 m.
Draught	0.50 m.
Passengers	4 Persons
Crew	1 Person
Service Speed	3 knots
Maximum Speed	6 knots
Propulsion system	Electric motor, battery, solar cell.
Material	GRP

## 1) Hull Form

High wake that resulted from vessel hull has always been the greatest challenge to marine engineers and designers. This wake is an unavoidable phenomena just like air turbulence from a flat boot of a car, such as those found in station wagon. However for surface craft, this phenomenon can be reduced to an acceptable limit with appropriate design of its hull. The asymmetric catamaran hull form design for boat was chosen, because it can reduce wake wash generated by vessels [3]. After CFD and model testing carried out by the group, the final catamaran hull form was selected as shown in Figure 1.



**Figure 1. Final Catamaran Hull form**

## 2) Material

The present coating on most inland waterways vessels react with the environment causing the water and adjacent air to pollute. With this in mind, the team carried out literature study.

Glass Reinforced Plastic (GRP) was chosen as prototype materials. There are many advantages using this material such as easy to process, low maintenance, and the important thing is corrosion resistant. No secondary painting of the hull is needed.. The disadvantage of GRP is it is difficult to recycle. The only way of recycling that seems to have been investigated to any extent is grinding the material up and using it as resin filler in applications where there is a need for volume and demands of strength are less critical. Otherwise the main disposal method is controlled combustion [4].

### 3) Propulsion Systems

Electric motor was chosen as propulsion system. Electric motors are highly efficient. They require no fuel, engine-oil maintenance, and do not freeze in sub-zero temperatures. Motors contribute to the safety of the work environment, emitting little noise, no exhaust, and without flammable fuels.

Solar cell was chosen as auxiliary power source to support the batteries. Solar cells are totally silent and non-polluting. As they have no moving parts they require little maintenance and have a long lifetime. The main disadvantage of solar energy is the initial cost. Most types of solar cell require large areas to achieve average efficiency. Air pollution and weather can also have a large effect on the efficiency of the cells. The silicon used is also very expensive and the problem of nocturnal down times means solar cells can only ever generate power during the daytime.

### 3. Conclusions

The final catamaran hull form i.e. an asymmetric demihull with Flat side faced outward configuration was selected as it generate low wake wash [5]. The out board electric motor is used in this prototype for its low noise, no gas emission, and no discharge. Solar cell is chosen as it is totally silent and non-polluting. Glass Reinforced Plastic (GRP) was chosen as prototype materials, because it is easy to process, low maintenance, and corrosion resistant.

### References

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